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A CLINICAL STUDY OF FORTY CASES OF CEREBRO-SPINAL MENINGITIS, WITH REFERENCE TO THE EYE SYMPTOMS.

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(*Read before the Johns Hopkins Hospital Medical Society, May* 1, 1893.)

There is hardly a subject in general medicine where the eye symptoms are more often dwelt upon than in cerebro-spinal meningitis, and probably in every case of this disease the eye shows involvement in some one or more of its parts. Most writers then lay stress upon the frequency and importance of these symptoms.

The following are some of the common conditions of the eye in epidemic cerebro-spinal meningitis: The eyelids may swell up and present the appearance seen in purulent ophthalmia. Conjunctivitis and photophobia are frequently seen. The pupils are often dilated, or one may be dilated and the other contracted, or both may be contracted. In some cases pus has been observed in the anterior chamber. The cornea is not unfrequently involved, showing itself in parenchymatous keratitis. Wilson[1] reports five cases where the cornea was affected, and in every case blindness followed. Niemeyer[2] also mentions in his monograph the frequency of corneal complications. Wilson[3] often met with inflammations of the choroid and iris, and in this connection Knapp[4] made some interesting observations during the epidemic of Rastadt and the vicinity of Heidelberg. According to the statistics of the physicians of that region, from 4–5 per cent of the sick were affected with an intra-ocular disease, which Knapp describes as a very peculiar one. The latter saw ten cases, and in every case but one blindness resulted. The trouble came on generally in the second and third week, and within three or four days led to blindness. In the majority of the cases the appearances of irritation were insignificant. Slight pain in eyes and forehead, with some subconjunctival injection. Iris generally discolored and frequently synechiæ. The reflex was a whitish gray. In other cases the symptoms were more violent, great redness and serous œdema of the mucous membrane of the eyeball. Intense redness of eyelids, yellowish-red discoloration of iris and often hypopyon. The disease lasted from one to several weeks, leaving the eyeball soft and absolutely blind. In all ten cases there was only one instance where both eyes were affected, and every eye attacked was destroyed. Knapp looks upon it as a hyperplastic choroiditis with consecutive retinal detachment and iritis.

Kreitmair,[1] of Nürnberg, observed the same condition in twelve or fifteen cases, and both he and Salomon,[2] who

[1] Diseases of Eye in Cerebro-spinal Meningitis. Dublin Quart. Jour. Med. Sc., Vol. XLIII, p. 300.

[2] Die epidemische Cerebro-spinal Meningitis. Berlin, 1865.

[3] *Loc. cit.*

[4] Centralblatt für die medicinischen Wissenschaften, 1865, No. 33.

[1] Aerztliches Intelligenz-Blatt, 1865, No. 22, S. 309.

[2] Berl. klin. Wochenschr., 1864, No. 33, S. 330.

examined six cases of meningitis affected similarly, look upon it as a simple irido-choroiditis. Jacobi,[1] however, regards the disease as a purulent inflammation of iris, ciliary body and choroid, associated with cell proliferation in vitreous and a sero-sanguinolent exudate between retina and choroid.

Oeller[2] observed retinitis and suppurative cyclitis in a case of cerebro-spinal meningitis. Markusky,[3] of Breslau, mentions a case of double panophthalmitis, consecutive no doubt to purulent choroiditis, such as is described by Jacobi and others. According to Hirsch,[4] conjunctivitis is an almost constant condition, which he describes as accompanied with more or less deep redness of the conjunctiva, moderate mucous secretion, or as a true blenorrhœa of the conjunctiva with thick purulent and very profuse discharge. This complication Hirsch observed more frequently in the earlier stages of the disease. Ziemssen and Hess,[5] in their monograph, allude to the almost invariable occurrence of conjunctivitis.

It is evident, then, that the occurrence of eye symptoms is a common one in cerebro-spinal meningitis, and in these epidemics of the disease there ought to be made, as far as possible, an examination of the eyes, and especially an examination with the ophthalmoscope. Such symptoms have an important place in the history of the disease, and they often more than any other symptom indicate the extent of the nerve involvement.

The external diseases of the eye are those which are most often mentioned in connection with this disease, but when it is remembered that there is a direct communication between the arachnoid space of the brain and cord with the deeper structures of the eye through the intervaginal space, it can readily be understood that a systematic examination of the fundus of the eye will often reveal changes which are of deeper significance than the invariable conjunctivitis. An examination of the fundus of the eye should not be thought unnecessary so long as the patient can see, for it is surprising to what a stage a disease of the choroid, retina, or optic nerve can advance without causing any subjective symptoms whatever, or I may say symptoms of which the patient would be conscious in the face of great physical suffering. Ziemssen and Hess do not mention a case of intra-ocular trouble, but in the twenty-two fatal cases reported by them I feel sure the ophthalmoscope would, in some instances at least, have revealed lesions of the fundus of the eye, and there is no reason to believe that such an ophthalmoscopic examination was made. As far as I can learn, Schirmer[6] alone has made systematic examination of the fundus of the eye in an epidemic occurring in Greifswald, and, strange to say, in only one case did he find an intra-ocular lesion, and that was double optic neuritis.

Thirty-five of the cases which I here record were examined by me ophthalmoscopically, and nearly all of them several times during the course of the disease. The other five cases I unfortunately failed to see, but as they presented eye symptoms, I simply allude to them without giving the histories in detail. Three were affected with divergent strabismus, another had one pupil enormously dilated, and in the fifth case the patient was totally blind a few days before death, a condition no doubt due to a fundus lesion. The following cases came under my own observation. I have seen fit to mention, in addition to the eye symptoms, some of the most prominent clinical features in each case.

1. Agnes Scott, 9 years old. *Intense congestion of papilla in both eyes.* Corneæ clear. Conjunctivitis, photophobia, pupils active and dilated, the right more than the left. The veins of the fundus engorged and very tortuous. The blood in the veins looked several shades darker than normal. Arteries not noticeably affected. The optic disk was very hazy, evident congestion, though there was no swelling. This condition more marked in right eye. Other symptoms were herpes, paralysis of entire right side on twelfth day, constant pain in neck and head. Temperature from 105°-98°. Pulse over 200-98. Death on eighteenth day.

2. Florence Duckworth, 15 years old. *Neuritis optica right eye.* Corneæ clear, pupil of right eye much dilated and marked divergence of this eye. Left eye normal. Other symptoms—total deafness, purpuric spots over breast and abdomen, opisthotonos, epistaxis. Temperature from 103°-95.5°. Pulse 136-86. Died on twentieth day.

3. Thos. Byers, 2 years old. Corneæ clear. Photophobia, pupils dilated. *Ptosis right eye and divergent strabismus.* Fundus of both eyes normal. Other symptoms: great neck and head pains, Cheyne-Stokes respiration. Temperature 100° (average). Pulse 192-88. Death on the thirty-fifth day. This child was only examined ophthalmoscopically two weeks before death.

4. Bessie Byers, 4 years old. *Eyes normal.* Opisthotonos, swollen joints. Pulse 144-60. Coma. Death on thirtieth day. This patient was only examined ophthalmoscopically two weeks before death.

5. Mrs. Ford, 35 years old. *Nystagmus.* No eye symptoms beyond the nystagmus on horizontal axis, a most singular phenomenon and one which I had never seen before. Other symptoms: opisthotonos and constant delirium. Temperature 104°-98°. Pulse 180-98. Coma. Death on fiftieth day. This patient was only examined ophthalmoscopically two weeks before death.

6. Willie Ford, 13 months old. *Congestion of papilla.* Corneæ clear, pupils dilated, veins engorged and presenting much the same appearance as in case 1. Other symptoms: opisthotonos, swollen joints, herpes, Cheyne-Stokes respiration. Temperature 104°-98°. Pulse 176-108. Convalescent on sixty-sixth day.

7. Julia Martin, 5 years old. *Neuritis optica.* Examined in second week. Pupils widely dilated and sluggish. Fundus normal. Seventh week: papilla in each eye was a smoky white and the point of exit of the blood-vessels was obscured, veins dark and tortuous, arteries narrowed. Divergent strabismus. Other symptoms: opisthotonos, limbs covered with a dusky red eruption. Comatose condition four weeks before death; frightful emaciation. Death on forty-eighth day.

8. Alick Hendra, 4 years old. *Congestion of optic disks.* Examined on ninth day. Pupils normal, so also corneæ, conjunctivitis. Papilla violet-tinted, no swelling, veins somewhat dilated and tortuous. Convalescent on fortieth day.

9. W. Richmond, 5½ years old. *Intense congestion of retinal veins.* Corneæ clear, pupils dilated. Papilla had the purplish color so often seen in these cases, great venous engorgement and tortuosity. The larger veins commenced to become tortuous immediately at edge of papilla and assumed the most contorted shapes before coming to an end. The turns were so abrupt in these vessels and so numerous that the blood at the turning-points appeared almost

[1] Archiv für Ophthalmologie, Bd. XI, 3, S. 165.
[2] Archiv für Augenheilkunde, 1879, S. 357-378.
[3] Centralblatt für prak. Augenheilk., Juni, 1879.
[4] Die Meningitis Cerebro-Spinalis Epidemica, S. 64. Berlin, 1866.
[5] Deutsches Archiv f. klinische Medicin, Bd. I, S. 442-443.
[6] Klin. Monatsbl. f. Augenheilk., 1865, p. 275.

stagnant and clotted. There was evident congestion, but no swelling of disk. Divergent strabismus. Other symptoms: total paralysis of right side, opisthotonos, and inability to speak ten days before death. Total deafness. Coma. Death on thirtieth day.

10. Lizzie Laird, 15 years old. *Eyes normal* in every respect. Convalescent on thirty-fifth day.

11. Bessie Harden, 16 years old. *Congestion of retinal veins and papilla.* Examined on tenth day. Corneæ clear. Pupils much dilated and divergence of right eye. Veins greatly engorged and tortuous in both eyes. Congestion of papilla. The veins showed the same dark appearance seen in most of these cases. Persistent opisthotonos. Temperature 97°–104°. Recovered.

12. May Atkinson, 10 years old. *Neuritis optica.* Examined on day before attack. Corneæ clear. Pupils active. Veins of right eye much distended and engorged, and blood very black. Left eye normal. Four weeks later I found a typical optic neuritis in both eyes, more pronounced in right eye. Pupil of right eye enormously dilated and left pupil unchanged. Photophobia. Other symptoms: opisthotonos, herpes, epistaxis. Temperature 105°–97°. Pulse 176–108. Coma. Death on thirty-second day.

13. Geo. Smith, 11 years old. *Intense congestion of papilla.* Four weeks sick when examined. Veins much engorged and dark. Marked divergence of right eye. Conjunctivitis. Pupils widely dilated. Died on thirty-first day.

14. Nettie Duckworth, 9½ years old. *Eyes normal.* Taken sick on February 14th, examined on February 24th. Eyes normal in every respect. Patient at this date is entirely well.

15. Alberta Reese, 3 years old. *Congestion of disk and retinal veins.* Three weeks sick when first examined. Pupils active and normal. Papilla smoky. Slight divergent strabismus; veins of retina dark and engorged, but no tortuosity. Papilla normal and arteries normal. Recovered.

16. Anna Teesdale, 7 years old. *Congestion of disk and engorgement of retinal veins.* Examined on eighth day. Great engorgement of veins of right eye. Papilla of right eye showed evident signs of congestion. Left fundus normal. Both pupils active and normal. Other symptoms: opisthotonos, intense head and neck pains, herpes. Convalescent on twelfth day.

17. Wm. Lehr, 7 years old. *Neuritis optica.* Examined first on sixth day. Neuritis and great engorgement of veins, the blood in the latter having that exceedingly black color which I have described as characterizing the venous blood in these cases. Pupils active. Two weeks later, the neuritis more pronounced; this condition was present in both eyes. Other symptoms: opisthotonos and constant head and back pains. Temperature from 98°–102°. Pulse 124. Comatose for four weeks and died on eighty-first day.

18. May Richards, 5 years old. *Intense congestion of retinal veins with engorgement, hazy papilla.* Sick two weeks when examined. Pupils active. Conjunctivitis. Papilla in both eyes very smoky. Veins dark and tortuous. Two weeks later no change in fundus, but pupils contracted. Other symptoms: opisthotonos, head and neck pain constant. Temperature 102°–99°. Pulse averaged 100. Died on seventieth day.

19. Robert Cole, 3 years old. *Engorgement and tortuosity of retinal veins.* Examined him on tenth day. Pupils normal. Conjunctivitis. Engorgement and tortuosity of veins in both fundi. Other symptoms: opisthotonos, constant pains in back and head. Temperature 99°–102°. Pulse 120–140. Coma. Death on twenty-seventh day.

20. T. Richards, 16 years old. *Retinal veins dilated and tortuous.* Examined on tenth day. Pupils active and normal. While there was no neuritis in this case, there was noticeable engorgement and prominence of the veins, the latter being unusually tortuous. Arteries somewhat narrower than normal. Papilla somewhat hazy. Other symptoms: opisthotonos, head and neck pains constant. Died on nineteenth day.

21. May Gunnett, 13 years old. *Congested papilla, tortuous and engorged retinal veins.* Examined on fourteenth day. Pupils much dilated and sluggish. Veins of retina very dark and tortuous. Arteries presented nothing striking. Papilla congested. Other symptoms: herpes and great swelling of joints, opisthotonos and intense pain in head. Recovered.

22. Rose Skidmore, 14 years old. *Pronounced congestion of retinal veins and papilla of right eye.* Examined in third week. Pupils large and sluggish. Veins of retina prominent, tortuous and the blood very dark. Papilla of right eye somewhat smoky. Other symptoms: opisthotonos, head and neck pains. Temperature 103°–98°. Pulse average 125. Complicated with measles. Recovered.

23. Agnes Winter, 11 years old. *Marked congestion of disk in both eyes.* Saw her in second week. Conjunctivitis. Divergent strabismus. Great congestion of disk in both eyes. Engorgement and tortuosity of veins. Pupils active but widely dilated. Other symptoms: pain constant and intense in head and neck, swollen joints. Temperature from 100°–99°. Pulse average 125. Died in fifth week.

24. J. V. Bateman, 21 years old. *Divergent strabismus, totally blind before death.* Pupils widely dilated. Divergent strabismus, and before death was almost blind, indicating without a doubt serious involvement of fundus, probably neuritis optica. This patient I failed to see before death. Other symptoms: opisthotonos, great pain in neck and head, herpes, totally deaf. Death on twenty-eighth day.

25. Geo. Patterson, 15 years old. *Divergent strabismus, right pupil widely dilated.* Pupil of right eye enormously dilated and left eye unchanged. Right eye diverged. This patient died before I could see him, and I am indebted to Dr. Porter for this history. Other symptoms: pulse could not be counted, intense and agonizing pain in head and neck. Died in fifty hours.

26. Roy Rowan, 3 years old. *Conjunctivitis and congestion of optic disks.* Sick three weeks and pronounced convalescent. When examined, pupils normal. Conjunctivitis. Disk congested and veins noticeably prominent in both eyes. Other symptoms: opisthotonos in acute stage, herpes on chin and hand.

27. G. Schloss, 3 years old. *Conjunctivitis, pupils enormously dilated, fundus normal.* Examined in tenth week. Conjunctivitis. Pupils enormously dilated. Fundus of both eyes normal. Other symptoms: pain in head and neck and opisthotonos. Temperature 104°–98°. Pulse average 120. Coma. Death in eleventh week.

28. L. Harris, 5 years old. *Congestion of both optic disks, venous engorgement and tortuosity.* Saw him in third week. Pupils largely dilated. Venous engorgement; the tortuosity of veins noteworthy, and their intense dark color made the arteries look pale in contrast. Nerve pale and hazy. Other symptoms: opisthotonos appeared late in the disease, pain in neck and head. Temperature 103°–97°. Pulse 160–80. Convalescent.

29. D. Durst, 9 years old. *Neuritis optica, more marked in right eye.* Examined at end of third week. Pupils dilated. Conjunctivitis. Engorgement of veins with tortuosity. Arteries narrow, and marked swelling and cloudiness of papilla. This condition was present in both eyes, but especially pronounced in right eye. Other symptoms: constant opisthotonos and intense pain in head. Death on twenty-third day.

30. Wm. C. Rowe, 20 years old. *Normal eyes.* Saw him in sixth week, when pronounced convalescent. Pupils widely dilated and optic disk in both eyes noticeably congested, though there was no swelling. Other symptoms: opisthotonos, delirium. Temperature 103°–97°. Pulse 108–88. Convalescent.

31. O. Smith, 7 years old. *Optic neuritis (double).* Examined in fourth week. Pupils normal. Typical optic neuritis in both eyes. Papilla much swollen, veins tortuous and dark. Other symptoms: opisthotonos and prominent head and neck pains. Temperature 104°–100°. Pulse 70–60–125. Alive when last heard from.

32. H. Dye, 14 years. *Normal eyes.* Sick one week. Temperature 103°. Recovered.

33. David Gardner, 7 years. *Marked congestion of optic disks.* Conjunctivitis. Active pupils. Total deafness. Temperature 104°-99°. Died in third week.

34 Jennie Laird, 10 years old. *Marked congestion of retinal veins, tortuosity of latter.* Examined in second week. Opisthotonos and constant pain in head and neck. Died in fourth week.

The following case I have reserved for the last, for it merits a more detailed account and is by far the most interesting condition with which I met in this epidemic:

35. Jennie Smith, 20 months old. *Hemorrhagic retinitis, thrombosis of the central vein.* When first seen the child had been sick only six days, and I found the eyes perfectly normal. Three weeks later I made another examination and found the following condition: Right eye, pupil widely dilated and rigid. The upper half of the papilla was nearly covered by an extravasation. This latter resembled a blood-clot and seemed to fill up the entire optic nerve excavation. The color was a deep blackish-red, and from this point on, out into the retina, the large arterial branches were almost empty, simply showing a faint column of blood. The arteries further than this presented nothing unusual. The veins were enormously distended and tortuous, and the blood in them very dark. There were several hemorrhages around the papilla. That part of the papilla not covered by the clot was pale and smoky. The retina was cloudy throughout, but no special changes were to be seen in the macula region, nor were there any hemorrhages except in the immediate vicinity of the optic nerve entrance. The very dark color of these hemorrhages was striking.

Left eye: Pupil rigid and dilated. Arteries of the retina possibly narrowed, though they presented nothing noteworthy. The veins very tortuous and engorged, and numerous hemorrhages were to be seen right around the optic nerve entrance. The retina was cloudy. The interest of course centers around the fundus of the right eye.

Thrombosis of the central vein was first described by Michel,[1] who recognizes three varieties: 1st, when there is complete closure of the vein by a thrombus; 2d, an incomplete closure, and 3d, a slight closure causing more or less stasis in the veins. My case comes under the third head. Michel finds retinal hemorrhages in every case and great engorgement of the veins.

"When the lumen of the central vein is partly or entirely blocked up a high degree of stasis results. And under circumstances it can readily be understood that when organization of the thrombus has taken place the coagulation will continue on up into the ramifications of the retina. As a result of this stasis extravasations occur, which are generally most numerous in those parts adjacent to the closed lumen of the central vein. Hence it is the optic nerve entrance and that part of the retina immediately adjacent which has the appearance as though located in a lake of blood."

The stasis can be recognized by the deep black-red color of the blood and the tortuosity and distension of the venous branches. The circulation in the arteries appears to be reduced to a minimum. In the seven cases reported by Michel the ages ranged from 81–51, and in every case there was present a high grade of arterio-sclerosis, sometimes emphysema and slight hypertrophy of right or left ventricle.

Age seems to play an important part among the etiological factors causing obstruction in the retinal vessels. As for instance, among fifty cases of embolism of the central artery reported by Popp,[1] the youngest case was 21 years old, and the average age was 48 years. And in Blanco's[2] report of the same class of cases occurring in Galezowski's clinic the average age was 46 years, and furthermore he finds cardiac involvement in every case.

We find then that embolus of the central artery and thrombosis of the central vein have causes in common. The form of thrombosis of the central vein in this case belongs, I should say, to that class called by Angellucci[3] the phlebitic (die phlebitische Form) in contradistinction to that form known as the marantic, which is seen only among those of advanced age. The first variety is met with oftener in younger persons. This case is, as far as I can find out, the youngest case that has ever been observed.

The thrombus must have formed in the vein just below the edge of the excavation. The large blood-clot I think rather indicates this. This clot, as will be seen from the diagram, fills up the excavation, and by its presence alone at this point could interfere, through pressure upon the artery, very materially with the circulation. It is difficult to indicate, except in water colors, the anæmic condition of the arteries, but a faint line of blood should be seen in the arterial branches in the picture. This is one of the strongest points in favor of its being thrombosis of the central vein rather than embolus of the artery. The hemorrhages of course, and the lack of changes in the macula region, still further strengthened this view of the case. As to the condition being what is known as hemorrhage into the optic nerve, I rather agree with Angellucci when he says with reference to his two cases, that in those cases where the diagnosis of optic nerve hemorrhage was made, that such a diagnosis rested entirely on the clinical observation, and were called such simply because the picture did not agree with what is recognized to be the picture of embolus of the central artery. Against this view of the case speaks most emphatically the similarity, or rather the agreement of the ophthalmoscopic condition with that described by Michel and Angellucci as peculiar to thrombosis of the central vein. The child had Cheyne-Stokes respiration when I saw it, and this condition had been present for six days. She died eight hours after my examination.

From this it will be seen that of the thirty-five cases examined by me the fundus was normal in only seven cases (3, 4, 5, 10, 14, 27, 32), and that of these seven cases one (case 3) had divergent strabismus and dilated pupils, another (case 5) had marked nystagmus, and still another (case 27) had greatly dilated pupils. I examined both the Byers children (cases 3 and 4) early in the disease, and though the fundus was normal in each case, it is probable that had the eyes been examined ophthalmoscopically a few days before death, changes in the fundus would have been discovered. This in the light of past experience.

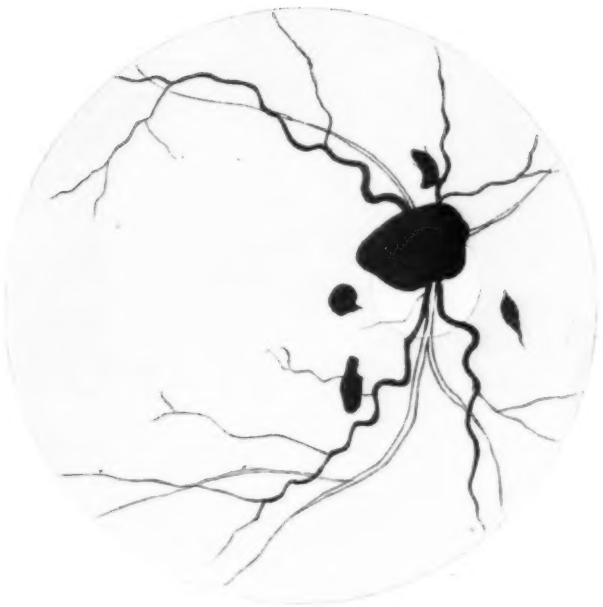
The same was the case with Mrs. Ford (case 5), whose illness was a lingering one, and whom I examined in the earlier

[1] Archiv für Ophthal., Bd. XXIV, S. 37-68.

[1] Ueber Embolie der art. cent. retinæ. Inaugural Diss., 1875. Regensberg.

[2] Étude sur l'embolie des vaisseaux rétiniens. Paris, 1873.

[3] Klinische Monatsbl. f. Augenheilk. 1879–1880.



(CASE 35.) THROMBOSIS OF THE CENTRAL VEIN.

[To accompany Dr. Randolph's paper.]

stages of the disease, but who even then had a singular form of nystagmus. I found neuritis optica in six cases (cases 2, 7, 12, 17, 29, 31). In the last case the neuritis was very pronounced. The optic disk in each eye resembled the mouth of a cylinder out of which was issuing smoke, the immediate point of exit of the vessels being entirely obscured.

There was one case of retinitis—the Smith child, case 35—with which was associated also thrombosis of the central vein of the right eye. The other nineteen cases were (as regards the fundus of the eye) characterized especially by great venous engorgement and tortuosity, and more or less congestion of the optic disk.

In the eight cases of divergent strabismus it was the right eye that diverged. In four cases the right pupil was dilated and the left unchanged. In three cases the neuritis was more marked in the right eye, and it will be remembered that the thrombosis in case 13 was in the right eye. I can give no satisfactory reason why the right eye more often showed abnormal conditions than the left. This peculiarity has been observed by Wilson,[1] Kreitmair[2] and others. The average age of my patients was nine years; the oldest was thirty-five and the youngest thirteen months. Gehrer[3] of Giessen reports three cases of children under three months old, two of whom died. The three cases, where eye symptoms were entirely absent, were all females: two of these recovered, the other died, and, as I have before remarked, I believe that in this latter case lesions in the fundus would have been discovered had the eyes been examined a few days before death.

Nearly all of these cases occurred in Lonaconing, a town of 6000 inhabitants, in the western part of the State. The others were in Frostburg, Barton and Piedmont, towns in the same section, within a few miles of one another.

Lonaconing and Barton lie in what is known as the George's Creek Valley, and their location is not unlike that of Norwich in Chenango county, N. Y., where an extensive epidemic of cerebro-spinal meningitis happened in 1888, and which was reported by Brooks.[4] George's Creek serves as a drain for these towns, and its waters were of course never used for drinking purposes. Living in the lower portions of the town, along the banks of this stream, did not seem to be attended with greater dangers, nor did residence in the higher parts of the town bring with it increased safety. The town of Frostburg, which is several hundred feet above the Lonaconing valley, experienced great mortality. In several of the cases the houses were located on hills far removed from George's Creek.

Case 30 (May Atkinson), which was of a particularly violent type, was on a mountain, 300 feet above Lonaconing, and as regards this question of location I was struck by the utter absence of anything like cause and effect in the history of the disease as I saw it in Frostburg. One could scarcely have chosen points where each patient would have been more remote from one another than I found them in the town of Frostburg. There seemed to be absolutely no geographical reason for it. The domestic hygiene attracted my curiosity, but I found, as regards the relative location of privies and wells or springs, such contradictory conditions that these features became of little or no value as factors. Seeing whole families drinking with no bad effects water from a well located sixty feet down the hill from a line of privies, and then visiting a family where this position was reversed, and meeting with a violent case of meningitis, was not helpful evidence in favor of any one theory. In Lonaconing, perhaps, the cases were more grouped than at other points in this valley, as for instance cases 3, 4, 5, 6 were all on what is known as Buck Hill. And again, case 12, and two others which I failed to see, were on Jackson Hill. In several instances more than one member of a family was attacked, and this I think was due to overcrowding, for in the earlier part of the epidemic the weather was extremely cold, and the miners with their large families would congregate in the warmest room in the house, which often happened to be the sick-room, and the consequence was vitiated air and the devolopment of conditions favorable for the spread of the disease. Latterly, since the weather has moderated and the windows and doors are opened, it is seldom that one sees more than one case in a family, and the families are nearly all large.

In this connection it is interesting to note that Dr. Guhlberg,[1] of Marburg in Germany, reports that the twenty-four cases observed by him in an epidemic had fifty brothers and sisters, and no means were taken to isolate the sick, and frequently the sick and well slept together and not a single one took the disease.

Cases 3 and 4 were sick in bed with their mother, who was at the time in her confinement. Both children died, and neither the mother nor the infant contracted the disease.

It is singular that every case of strabismus was of the divergent variety. The cases of neuritis I take to be of the descending variety, involving the entire trunk of the nerve and its sheaths. It is possible that the numerous instances of congestion of the optic disk were simply beginning stages of optic neuritis. It is more than likely that had any of the six cases of neuritis survived, atrophy of the nerve would have followed. Such a condition I have recently seen in a boy who had cerebro-spinal meningitis eight months ago, and who is nearly blind at present.

Three years ago I saw a child who, to all appearances, was totally blind during a long illness of meningitis, and where marked neuritis optica was present. Bad vision persisted for some time after recovery, and when I saw the child again he was just able to find his way about. A year later I learned from his family physician that he could see as well as ever. Williams[2] reports a case similar to this one.

The treatment in these cases of consecutive atrophy is just as unproductive of good as one finds in the treatment of atrophy from other causes, though Moos[3] and Mauer[4] each

[1] *Loc. cit.*
[2] *Loc. cit.*
[3] Oesterreichisches Jarhbuch für Pediat., Jahr. IV, Bd. I, S. 71.
[4] Med. Press West. N. Y., Vol. 3, page 512.

[1] Wiener Med. Wochenschr. 1886, No. 23, S. 822.
[2] Weekly Med. Review, 1884, Vol. 9, p. 416.
[3] Archiv für Augen- und Ohrenheilk. 1869–70, Bd. I, S. 216.
[4] Med. Gaz. 1880, Vol. 7, p. 687.

reports a case where sight was restored by the hypodermatic injection of nitrate of strychnia and the employment of the constant current.

It would seem, then, that all epidemics of cerebro-spinal meningitis have one or more eye symptoms in common, and probably those most often met with are the changes in the pupils and conjunctivitis. But every extensive epidemic is apt to be associated with a special type of eye affection. Thus Knapp, Kreitmair, Oeller and Jacobi observed most often suppurative inflammation of the uveal tract, and make no particular mention of any other ocular complication. Wilson, Niemeyer, Ziemssen and Hess met with keratitis, while Hirsch, in his wide experience, saw nothing more serious than conjunctivitis, which was an invariable condition. The type of eye symptoms peculiar to the epidemic which I have just described seems to have been a remarkable tortuosity and distension of the retinal veins and more or less congestion of the optic disk. The degree of venous engorgement in some of the cases was, in my experience, a unique condition, the blood appearing almost black and as though actually stagnant. The tortuosity of the veins, too, was striking. The turning points of the veins were so abrupt that they resembled small hemorrhages, and as such I regarded them in one case till I was enabled later to make a more thorough examination, when I found that what I took to be hemorrhages were very abrupt turns in the veins where the circulation must have been almost at a standstill. These conditions are quite analogous to what was discovered in the brain in every case where a post-mortem was made. I was not present at any of the autopsies, but Dr. Porter told me that the tortuosity and distension of the veins on the surface of the brain reminded him forcibly of my description of the retinal veins, and the changes in these vessels I think can readily be understood from the condition of the brain revealed at the autopsy.

It is clear, then, that in all epidemics of cerebro-spinal meningitis a systematic examination of the eyes should be made with the ophthalmoscope, and that frequently when other eye symptoms are absent and the general symptoms are misleading, changes in the fundus of the eye will be discovered which will throw light upon the case. And again, the existence of good vision does not mean a sound optic nerve or retina, for not unfrequently do we meet, in every-day work, with a choked disk where the visual disturbances are insignificant. Of the thirty-six cases which I examined, not counting those which were affected with diplopia, only three complained of their inability to see distinctly. I regard the existence of eye symptoms, especially those where the fundus is involved, as indicating a particularly grave case. Wherever I found the condition which I have described very pronounced, I felt justified in speaking positively as regards the prognosis. I think that this type of eye symptoms is of more value as indicating the condition of the brain than the symptoms described by other writers, such as panophthalmitis, suppurative choroiditis and keratitis, affections which, in my opinion, would be likely to have their origin in a general infection and not likely to be the direct result of the purely cerebral changes.

I take this opportunity of expressing my sense of obligation to my friends, Drs. M. G. Porter and W. Q. Skilling, of Lonaconing, Md., and to Dr. Marshall Price, of Frostburg, for so kindly aiding me in my investigations. Through the co-operation of these gentlemen I have been enabled to carry out this work.

THE PLAGUES AND PESTILENCES OF THE OLD TESTAMENT.

By Dr. C. C. Bombaugh, of Baltimore.

[*Read before the Johns Hopkins Hospital Historical Club, January* 19, 1893.]

That grand old physician and scholarly writer, Sir Thomas Browne, says in his Urn-Burial: "What song the syrens sang, or what name Achilles assumed when he hid himself among women, though puzzling questions, are not beyond all conjecture." In matters of merely curious interest, this sort of approximate surmise or guesswork may answer well enough, but when it comes to questions of graver import it will hardly satisfy those of us who prefer exactitude in marshaling and arraying premises, and logical deduction in reaching conclusions. And the more—especially in antiquarian research—we are forced into acceptance of that which is conjectural in place of that which is fairly deducible or verifiable, the more sharply are we confronted with certain disconcerting reminders, or, as the weather people say, "cautionary signals."

In the first place, in days of yore when time was young, reporters in general, and medical reporters in particular, had not yet made their appearance. Up to the period of the slender primitive clinical records inscribed on the votive tablets in the temples consecrated to Esculapius, we have no tangible evidence of the existence of any rudimentary treatises on the nature of diseases or their treatment. True, there is no finer compliment to the ministers of the healing art than that in the xi Book of Homer's Iliad, no portraiture of the true physician more graphic than that of Hippocrates, no characterization more glowing than that in the xxxviii chapter of the uncanonical Book of Ecclesiasticus. But so long as medicine among the Egyptians, the Assyrians, and the Hebrews was monopolized by the priesthood, or among the Greeks controlled by the half-priestly, half-philosophic caste of the Asclepiadæ; so long as Romans in later days saluted an illustrious surgeon like Archagathus with the opprobrious epithet Carnifex (executioner), or an early Christian writer like Tertullian, in his philippic against Herophilus (whose name is still embalmed in the confluence of the sinuses, the torcular Herophili), classified anatomists and butchers in the same category, there was little to expect in the way of substantial contribution to diagnosis, to therapeutics, or to pathology.

In the second place, in oriental literature, even the simplest and most ancient, we encounter an oppressive superabundance of metaphorical writing. In many cases where fancy should have been regulated and exuberance restrained, figurative language was allowed unlimited scope. Hence, philological or linguistic difficulties constantly block the way to correct interpretation. We are also perplexed by the confusing admixture of medicine and theology, by the interlinking of remedial measures with superstitious and ceremonial observances, and by the interjection of the supernatural element, with continual reference to evil spirits and demoniac possession. And not the least of our difficulties is that of identifying ancient diseases with diseases with which we are familiar, in view of the fact that in the lapse of centuries, in the cycles of disappearance and reappearance, under ever-changing conditions of climate and food and habit and environment, some have been greatly modified, and others are no longer existent.

In the third place, under the present reign of the spirit of iconoclasm, no matter how patiently we delve for foundations upon which to rear a presumably secure superstructure, some relentless image-breaker is sure to come with his sledge-hammer and lay our fabric in ruins at our feet. Those of you who have gazed with interest upon the statue of Pompey, preserved in the Court of Cassation, in Rome, will remember that its authenticity as the original marble effigy in the Senate, at the base of which Julius Cæsar was assassinated, was accepted on what was considered irrefutable evidence by the most exacting and least credulous archæologists. Two or three years ago, Helbig, a German antiquarian, detected an error in the pedigree that was fatal to its long-standing claim. We have had to give up Penn's Treaty, and Pocahontas, and William Tell, and now we must surrender Pompey.

The application of the hit-or-miss ventures of assumption or speculation to the Sacred Scriptures, and particularly to the Old Testament, leads to strange as well as very divergent conclusions. Dr. Baron, the biographer of Jenner, for example, expresses the view that the boils and blains of the sixth Egyptian plague, as described in the ix chapter of the Book of Exodus, are convertible terms for small-pox. He bases this view upon a description of the plague by a Jewish rabbi of the first century, who closes a remarkable passage with a sentence which may well serve as a brief summary of the confluent form of small-pox. "For," says he, "to one regarding those cases in which the pustules were scattered over the body and limbs, and run together in one mass, it appeared as if they were a continual ulcer from head to foot." This is considerably weakened by the fact that it was written 1500 years after the Mosaic era, that there is neither record nor tradition of the existence of variola at that early period, and that if such an epidemic had occurred, the consequent ratio of mortality would have been chronicled in the Mosaic books.

There was another learned rabbi who undertook to prove that the tenth plague of Egypt (occasioning the death of the first-born) was due to cholera. This final infliction, which broke the yoke of Israel, was visited, as we are told in the xi chapter of Exodus, upon all the first-born throughout the land, "from the first-born of Pharaoh that sat on the throne, unto the first-born of the maidservant, and all the first-born of beasts." Those who are not slaves to the *ipse dixit* will naturally ask this rabbi to explain, independently of divine purpose and supernatural agency, how and why such elective affinity on the part of the cholera, confining its ravages to the primogeniture of Egypt, and leaving the children of Israel severely alone.

Still another example is furnished in Job's affliction. The old theologians, with Origen at their head, regarded Job's disease as a true leprosy, and several medical writers adopted the same view, although the description is just as applicable to other malignant diseases, more or less analogous in character. They also seem to have overlooked the fact that if the leprosy in Job's time was not the simple *lepra leuke*, or *lepra alba*, of the Books of Moses, but the tuberculated form, with its characteristic lesions and neoplasms, it was, of course, incurable, yet Job not only recovered, but lived, we are told, 140 years after recovery. Sir Risdon Bennett, in his interesting contribution to the series "By-Paths of Bible Knowledge," says that "the antiquity and the purport of the Book of Job, on which there is so much difference of opinion, and the metaphorical character of much of the writing, render it extremely difficult to speak with confidence on the precise nature of the disease which constituted so much of the patriarch's suffering and trial."

Reference to leprosy reminds us that no other disease is so frequently mentioned in the Bible. It is named between sixty and seventy times, and though the general term plague occurs twice as many times, at least one-half of the citations refer to leprosy, the expression "plague of leprosy" being especially frequent in the Book of Leviticus. Aside from such individual cases as those of Moses, Miriam, Naaman, and Uzziah, two long chapters of Leviticus (13, 14) are devoted to a minute description of the differential phases of the infliction, to the length of the quarantine to be prescribed by the priests, and to the regulations for the conduct and purification of the lepers. In dealing with these unfortunates, the uppermost idea was the promotion of cleanliness and the prevention of infection in conformity with the stringent exactions of the Levitical sanitary code. But it should be noted that however multiform the lepra of the Mosaic record, it was a cutaneous disease broadly contradistinguished from the constitutional malady which, in its progress, implicates the whole organism, and is sure, sooner or later, to terminate fatally. At one time, as we infer from the Levitical text, it is a leucoderma or vitiligo; at another it closely resembles psoriasis; here are squamous patches, there rough incrustations; here is diffused inflammation, there excoriation of the surface with exudation of serum and blood. But let it take what shape it might, it was evidently non-contagious, and even with the slender armamentaria of that early day, it was curable. It must have had little in common with that formidable, transmissible, bacillary disease which we call leprosy; it was unlike the elephantiasis of the Greeks or the Arabs, running more in the direction of atrophy than hypertrophy of the lower extremities; it exhibited no such extent of degenerative change, of destruction of substance, of disorganization

and disfigurement as those of the lepra mutilans. As Hamlet says, "no more like my father than I to Hercules."

Now if we take the term plague in the Bible aside from its direct application to leprosy—the plague of leprosy—we shall find it in large measure correspondent or interchangeable with the term pestilence. This word pestilence occurs in the Old Testament between forty and fifty times, and it is especially noteworthy that it is frequently conjoined with famine. Of course, these terms have a wide significance, and are sometimes applied to moral as well as physical evils. What we are more particularly concerned with has reference to those malignant epidemics which were so terribly destructive.

We can understand how Korah and his immediate followers, as related in Numbers, chap. xvi, were swallowed up by an earthquake, but when we are told that 14,700 of those engaged in the rebellion against Moses and Aaron were destroyed by a plague, whatever the specific communicable disease may have been, we are puzzled by the rapidity of its propagation. To use the scriptural expression, the offenders were "consumed as in a moment." Some writers incline to the opinion that it was cholera, others regard it as the septic infection to which the term plague is now commonly restricted, and which, to distinguish it from other malignant epidemics of the middle ages, has been called the Bubonic, Oriental, Levantine, or glandular plague. This "pestis inguinaria" with its characteristic buboes of the cervical, axillary, inguinal, and mesenteric glands, its pustules, petechiæ, and carbuncles, although its history cannot be traced farther back than the second century of our era, might satisfactorily account for and explain several of the pestilences of the Old Testament. For while in its diversified forms death may not ensue until the fifth or sixth day, we are told on good authority that in many cases it followed within twenty-four hours, that is to say, in advance of the usual swelling and inflammation of the lymphatic glands. Whether, therefore, the fate of the rebels referred to be accepted as a case of divine interposition and divine punishment of treason, or whether the adaptation of means to ends be not regarded as phenomenal or miraculous, there was allowance of time for incubation through the operation of the usual antecedents—accumulation of sewage and filth, contamination of air and water, effluvia from putrefactive matter, noxious gases, soil exhalations, and excessive crowding, with swift prostration and collapse through the intensity of the virulence.

It is perhaps easier, and quite as reasonable, to find in cholera the exciting cause in the well-known case of the quails. The Israelites, tired of their monotonous diet of manna, became mutinous, and demanded of their leader a flesh diet. We are told in the xi chap. of Numbers that a wind brought quails from the sea and let them fall by the camp, that all that day, all that night, and all the next day, the people gathered the quails, and spread them abroad for themselves round about the camp. "And while the flesh was yet between their teeth, ere it was chewed, the wrath of the Lord was kindled against the people, and the Lord smote the people with a very great plague." It is well known that quails in Oriental lands frequently feed on the seeds of hellebore and other poisonous plants; it will also be observed that immense numbers of them were lying around the camp for days exposed to a tropical heat, with resultant decomposition. In either of these facts may be found a key to the heavy mortality which followed such inordinate appetite for game.

With regard to the ever-memorable destruction of the Assyrian army in one night, Josephus says that "when Sennacherib was returning from his Egyptian war to Jerusalem, he found his army under Rabshakeh, his general, in danger of a plague, for God had sent a pestilential distemper upon his army; and on the very first night of the siege, 185,000 men, with their captains and generals, were destroyed." Commentators on Josephus have attempted various explanations, some venturing the notion that the destructive agency was lightning; others, a sirocco; others, by their "falling foul upon one another in the obscurity of the night," but all evade the question how a plague, as such, could cut so broad a swath in a single night. In a foot-note to the account of the disaster in Herodotus, it is asserted that the army was destroyed by a judicial pestilence, by which is presumably meant a pestilence in the nature of a judgment or punishment. But as to the character of the pestilence, the reviewer is discreetly silent, and so we are left to fall back upon the scriptural statement, and to let it rest there. "And it came to pass that night that the angel of the Lord went out and smote in the camp of the Assyrians a hundred four score and five thousand." This, by the way, reminds us of an expression of the late John Bright, in a speech in the House of Commons during the Crimean War: "The Angel of Death is hovering over us; we can almost hear the beating of his wings."

We have another instance of rapid execution of the death-warrant in the punishment of David for improperly taking the census of his kingdom. When David, as we are told in 2 Samuel xxiv, and also 1 Chronicles xxi, was forced into acceptance of one of three offers,—seven years of famine; three months' flight before the sword of the enemy; or three days of pestilence, he chose the third and last. "So," to quote the 23 verse, "the Lord sent a pestilence upon Israel from the morning even to the time appointed [72 hours]; and there died of the people from Dan even to Beer-sheba 70,000 men." This was a sweep, from the northern to the southern boundary of Palestine, of 160 miles, and a mortality ratio of one in twenty of the population.

It may be noted, in passing, that these cases of rapid depopulation in which the termination was as short, sharp, and decisive as the onset, find parallels in later profane history. For example, Hutchins, in his History of Dorset, in speaking of the plague which swept over northern Europe, and ravaged England, in 1348, says: "Few survived the seizure more than two or three days, some not half a day." In 1503, 20,000 men of the army of Zamoryn, sovereign of Calicut, India, died of a disease, believed to be cholera, which, according to Gasper Correa, proved fatal in less than eight hours. Tyenius, in speaking of the "sweating sickness" which devastated England in 1517, says: "So pestiferous, malignant, and contagious was the pain and inflammation of the throat that whoever, within six or eight hours' seizure, had not proper remedies applied, died in sixteen or twenty hours." So with regard to the enormously disproportionate rate of mortality to popula-

tion, we find in the 1500 pestilences recorded during the 19 centuries of the Christian era, some very remarkable parallels. For instance, during the reign of Titus (A. D. 80) a plague carried off the people of Rome at the rate of 10,000 a day, a diurnal ratio of one in 200. A century later, in the time of Antoninus, the oriental plague was introduced by the Roman army returning from the Parthian War with such overwhelming results that it paved the way for the decline and fall of the Empire. In the reign of Justinian, the plague which Gibbon so graphically describes was so violent in Constantinople (A. D. 558) that only a fraction of its population was left. Gibbon, on the authority of Procopius, says that during three months, five thousand and at length ten thousand persons died each day. In 1579 Cairo was visited with a pestilence which, in the course of eight months, according to Alpinus, destroyed 500,000 inhabitants, a daily average of 2000.

Sir Risdon Bennett, in his little book, "The Diseases of the Bible," says: "What interpretation we are to put on the vivid description of Zechariah of the plague with which the Lord threatens to 'smite all the people that fought against Jerusalem,' it is very difficult to say. 'Their flesh shall consume away while they stand upon their feet, and their eyes shall consume away in their holes, and their tongue shall consume away in their mouth.' If the description be not altogether metaphorical, may it not be intended to describe an army dying of famine?" Famine undoubtedly will account for a large ratio of the dreadful mortality so frequently recorded in the Bible. But the very strong language quoted reminds us that as Dr. Bennett's book was written for the Religious Tract Society, and not intended, like the *Medica Sacra* of Dr. Richard Mead, court physician to George II, for scientific readers, he conveniently avoids all reference to syphilitic infection. He makes no mention of the plague of Baal Peor, on which Buret dwells with such significant emphasis in his recently published book on "Syphilis in Ancient and Prehistoric Times." Making all allowance, however, for Buret as a hobby-rider, having good reason to believe that there were outbreaks long anterior to the siege of Naples, and remembering how writers of less exuberance speak of the visitation at Taberah (Numb. xi, 1), of the botch of Egypt (Deut. xxviii, 27), of the osteocopic suffering of David as detailed so graphically in Psalm xxxviii, there can be little question as to the nature of the results of the libidinous intercourse of the Israelites with the daughters of Moab. For the Baal Peor of the Moabites was the same as the Priapus of the Romans, and the temple on Mt. Peor was devoted to the Phallic worship. To exterminate the disease in obedience to divine command, the anger of the Lord, as we are told, being kindled against Israel, Moses directed all who were infected, 24,000 in number, to be killed. Later on in the pilgrimage, when Israel was at war with Midian, and captured the Midianites, Moses wrathfully exclaimed to his officers on their return, "Have ye saved all the women alive? Behold, these caused the children of Israel, through the counsel of Balaam, to commit trespass against the Lord in the matter of Peor, and there was a plague among the congregation of the Lord." He then applied as a preventive the treatment which on the former occasion had succeeded as a heroic measure, and ordered the officers to "kill every woman who hath known man by lying with him" (Numb. xxxi). It was a radical remedy, yet not too desperate to find imitators even in modern times. You remember that Napoleon, for instance, at Jaffa, ordered the plague-smitten patients in the military hospital to be put to death by poison.

We learn from the parish records of Ober-Ammergau that when the plague of 1633 was sweeping the byways of the Bavarian Tyrol, eighteen peasants met together and vowed that if the plague were stayed they would, once in ten years, present in living pictures the Passion of Christ. That vow has been faithfully kept. On Fish Street Hill, in London, where the Great Fire of 1666 started, the citizens erected a commemorative monument as an expression of their gratitude that the fire had destroyed the last vestige of the pestilence which, in the course of a few months, had carried off 68,596 of the inhabitants of the metropolis. We who live in an age of broader enlightenment have learned that the line of practical beneficence leads to prophylaxis rather than to religious vows or sacrificial offerings, and points to higher promise and larger performance. We, too, are building a monument, but it will be more enduring than stone or bronze, and will immortalize its trust in one word, SANITATION.

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PROCEEDINGS OF SOCIETIES.

THE JOHNS HOPKINS HOSPITAL MEDICAL SOCIETY.

Meeting of April 3, 1893.

Dr. Hurd in the Chair.

Exhibition of Dermatological Cases.—Dr. Lord.

1. This first case appeared at the Dispensary in January, 1891, with a sore upon the nose and upper lip. At that time the diagnosis of epithelioma was made in the surgical department and he was operated upon. In December of last year the trouble had returned and a section was removed for microscopical examination. It proved to be of granulation tissue resembling closely that of tuberculous origin, but it was impossible to find any tubercle bacilli, although some twenty specimens were examined. It was then thought to be specific and he was placed upon specific treatment, but without benefit. Two days ago he was taken with a chill and he now comes to us with an erysipelas of the face, and it will be interesting to note what effect this disease will have upon the ulcer which you see upon his face and which has refused to heal after repeated scrapings. At present the diagnosis is not certain; it resembles specific and also tuberculous trouble.

2. The next case, a man of middle age, presents also an ulcer upon the nose. It began some six years ago in the form of a small papule, which finally broke down into an ulcer, and has been gradually increasing in size until the whole of the right portion of the nose and adjacent part of the lip and cheek have been destroyed. Upon the right cheek and left temple there are several lesions which resemble closely those of syphilis. There is a scar also upon his left cheek which he states has been operated upon. A section was removed from this ulcer and it proved to be an epithelioma.

3. The third case, a German girl, 17 years of age, who has upon the back of her left hand a patch of lupus vulgaris. The disease began thirteen years ago, and has been spreading slowly until you see the present condition. The back of the hand and the middle, ring and little fingers are also involved. Her mother and father died of consumption, and a sister had a skin eruption which began early in life upon the arm and is still present. A section of this tissue was made and the tubercle bacilli were found in it. Sections from this case and from a case of syphilis were difficult to distinguish from one another, except by the presence of the tubercle bacilli in the lupus tissue. This disease is regarded as localized tuberculosis of the skin. The diseased area consists of granulation tissue in which one finds giant cells, epithelioid cells, round cells and tubercle bacilli, just as one sees in tuberculous tissue elsewhere. The disease begins in the deeper part of the corium in the form of small nodules, which later coalesce, forming patches of various size and shape. The further progress of the disease depends upon the change which the lesions undergo. Sometimes the skin returns to its normal condition. More frequently it undergoes fatty degeneration and breaks down in the form of ulcers, usually round and shallow and covered with granulation tissue. These may heal up and form a scar. When small the scars are smooth; when large they are irregular. It usually comes after the second year, and it is more frequent in the female sex. It is a rare disease in this country. It is rare for two members of the same family to have this disease.

Irideremia, Glaucoma Simplex and Zonular Cataract combined in one Patient.—Dr. Randolph.

A. J. Bell, 35 years old. He never remembers to have seen well, and has always noticed that his right eye was the worse of the two. At one time he could see large objects with this eye, but now he has only light perception. He noticed the vision in this eye began to fail ten years ago, and now the eye is a useless one. He has never had any pain. Tension in this eye is markedly elevated, and an ophthalmoscopic examination has revealed glaucomatous excavation. He has also zonular cataract, which you can see quite readily by oblique illumination. The condition of the iris is exceedingly interesting. You will observe that the iris is wanting in the lower and outer part of both eyes, and I should say that at least $\frac{1}{3}$ of the iris is absent. Scarcely more than a rim of iris is to be seen above and to the inner side. This condition is known as irideremia, and inasmuch as some iris still exists, it may be classed as incomplete irideremia.

The vision in the left eye is about $\frac{1}{200}$. The excavation of the optic nerve is not so marked, but still is unmistakably present. The refraction of this eye, just as it is of the right, is myopic. The irideremia does not strike one as being quite so extensive in this eye as in the other. The location of it corresponds to that in the right eye.

The anterior chamber, you will observe, is somewhat deeper in both eyes than we usually see, and this is due to absence of the iris. There is no noticeable increase of tension in the left eye.

The pupillary reaction is absent in both eyes, and the edges of the irides are somewhat atrophied. Color sense is normal; of course I speak of the left eye, but there is narrowing of the visual field on the nasal side. The blood-vessels of the fundus appear unaltered.

It is interesting to mention a few points in the family history of this patient. He tells me that his father and mother had good eyes. He has two brothers who have eye affections which he says are somewhat like his own, but about the exact nature of the disease he is uncertain further than that they are very near-sighted. He had an uncle who, he was told, was nearly blind the last few years of his life. This uncle was advised to have an operation performed or he would lose what sight he had. The operation was performed, but it did not appear to have been successful. I think it probable that the operation was iridectomy performed for the relief of glaucoma. His mother's youngest brother has a son who is even more afflicted than he himself. This young man was almost entirely educated in a blind asylum. He was also deaf. The patient's mother had also another nephew whose eyes were seriously affected, but who managed to get a position as steward in the British navy. His maternal grandfather had cataract. The influence, then, of heredity is strikingly seen in the history of this family, and it is the mother's side of the family which is affected. Whenever we meet with glaucoma in young persons it is in the form of glaucoma simplex. It is rare though that we see even this form of the disease under 45 years. The irideremia is no doubt to be attributed to an interruption in the developmental powers of the eye. I should say that heredity probably played an important part in the causation of the glaucoma and zonular cataract.

The Recent Outbreak of Epidemic Cerebro-Spinal Meningitis at Lonaconing and other places in the Valley of George's Creek, Maryland.—Dr. Flexner and Dr. Barker.

Dr. Barker regretted that owing to the absence of Dr. Flexner in Europe, that gentleman could not be present to address the Society on this subject. He, however, had, through the kindness of Dr. Welch, been permitted to accompany Dr. Flexner, who had been delegated by the State Board of Health to visit the diseased district for the purpose of studying the affection, and would speak briefly of the main features of the epidemic and of some of the conclusions which had been arrived at. He would leave all detail for the full report which was to appear when the researches which were still in progress should have been completed. The disease had prevailed in the mining towns of Lonaconing, Frostburg, Ocean and

Barton, and to some extent in the neighboring country districts, from January, 1893, with more or less varying intensity up to the present time. The majority of the cases had occurred in the families of miners, but no class of people was exempt, nor were the more well-to-do much less likely to be attacked than the poor and destitute. The sanitary conditions in the valley were about as unhygienic as could be well imagined, and it seemed only strange that the epidemic diseases of various sorts had not played more havoc there. In Lonaconing, where most of the time had been spent, a river runs through the center of the town and acts as a main sewer for it. The houses in the town were for the most part built in rows, tier above tier upon the sides of the steep hills which rise from either bank of the creek. The outhouses belonging to the dwellings were placed flat upon the ground and usually upon a higher plane. During a thaw or rainstorm, the sewage and refuse from the upper yards, outhouses and stables were washed down through the premises and past the dwellings of those who lived below. Upon the margins of the creek, in the very center of the town, were located the slaughter-houses, and refuse from these found its way unforbidden into the stream. The water supply of the place was derived chiefly from wells, and these were frequently contaminated with surface washings; besides, owing to their proximity to the creek, there seemed to be little doubt but that the well water had long been contaminated by percolation from the stream.

As to the distribution of the cases, it had been noted, as in certain other epidemics, that there was a tendency to grouping in little foci, chiefly in the elevated regions of the town, but there had been numerous examples of isolated cases. It was necessary to mention, too, that in many families overcrowding was evident.

Altogether, notes had been collected of some one hundred and twenty cases—severe, mild, and abortive; these did not include the cases in Frostburg, where the disease also prevailed to an alarming extent. The mortality, counting mild as well as severe cases, was about 40 per cent, corresponding, according to the standard of v. Ziemssen, to that of a moderately severe epidemic.

The beginning of the outbreak was associated with a dance which had been given on a bitterly cold night, and at which two young men overheated themselves and subsequently became severely chilled; both developed the disease next day. Later, numerous cases appeared in different regions at about the same time. Exposure to cold was a prominent predisposing factor, and a sudden cold-snap was sure to be followed by the appearance of fresh cases.

The symptomatology presented, as usual, marked irregularities. Examples of nearly all types of the disease had been met with, *foudroyant*, acute, subacute, intermittent, and chronic. The young had been chiefly affected—one case having been observed in a child of five months. Young adults were frequently victims, and older individuals were by no means immune, there having been several patients between the ages of 35 and 45. The onset was as a rule sudden, with severe pain in the head, and occasionally with rigor. There was often urgent thirst and projectile vomiting. The pain in the head was violent and almost intolerable, and passed on into delirium or stupor. Bright lights and loud sounds were painful; the eyes were prominent and watery and the conjunctivæ hyperæmic; cervical opisthotonos soon appeared, with general stiffness and hyperæsthesia of the body. Death sometimes resulted before the development of other symptoms, in one instance as early as five hours after the initial sign. In the less "explosive" cases the onset was usually sudden, too, but the progress was less rapid. Symptoms referable to involvement of the cranial nerves gradually appeared, and were of course most marked where there was evidence of extensive basal exudate. Among these were noted disturbances of sight, taste, smell, and hearing, eye muscle paralyses, nystagmus—vertical and horizontal (in one case rotary)—disturbances of cardiac and respiratory rhythm, cyanosis, and defective speech. The ophthalmoscopic changes had already been carefully described by Dr. Randolph. The temperature course was characterized only by its great irregularity, and varied often quite independently of the general phenomena. Complications in the joints—peri-articular and intra-articular effusions—were relatively frequent; in no less than 20 per cent of the severe cases was one or more joints affected. The knees, elbows, wrist, and ankles were involved, following in frequency in the order named.

The cutaneous symptoms varied as much in character and duration as any of the others. In some instances no skin eruption of any kind was observed, while in others there were larger and smaller spots and mottlings of red and purple. Herpes was very common, especially in the distribution of the cutaneous vessels and nerves of the face and neck. On the part of the digestive system, vomiting and dysphagia were the main symptoms. Constipation was the rule, although in a few cases there had been diarrhœa, and in two well-marked dysenteric discharges.

The urine was usually scanty and concentrated, and contained in severe cases a trace of albumin, a few hyaline casts, and an excess of phosphates. Ehrlich's diazo-reaction could not be obtained in any of the specimens examined.

Every opportunity had been afforded for a careful study of the blood in these cases of meningitis. The most constant alteration was the presence of an increased number of the white blood corpuscles, there being from 10,000 to 30,000 to the cubic millimetre. The study of dried and stained specimens (methods of Erhlich) had shown that this increase was due to an augmentation of the number of neutrophilic leucocytes with polymorphous nuclei—the characteristic change in all inflammatory leucocytoses. In a few instances the percentage of hæmoglobin and the number of red blood corpuscles was diminished. It had not been possible to palpate the spleen in any of the cases examined. The dulness had been found to be increased, but even this rarely passed the costo-articular line.

Dr. Flexner, during his stay, had succeeded in securing autopsies in two instances—(1) an acute case with lesions principally on the convexity of the brain, and (2) a subacute case with pronounced basal lesions. The first case occurred in the practice of Dr. Skilling. The child, a bright girl of nine, convalescent from an attack of mumps, had been suddenly seized one morning with vomiting, violent headache and severe pain in the back of the neck and along the spine. Opisthotonos soon followed. The child cried out loudly at intervals, and tossed uneasily from side to side. The symptoms grew gradually worse; the patient became delirious, and later comatose: the head was thrown back between the shoulder-blades; the temperature rose to 103.5°; the tongue became dry and brown; sordes collected upon the teeth and lips, and sibilant and sonorous rhonchi appeared in the lungs. The child died on the third day. At the autopsy, which was obtained within two hours after death, rigor mortis had begun in the extremities. The muscles were deep red in color, and much fluid blood oozed from them on incision. The longitudinal and lateral sinuses of the brain were dilated and filled with dark fluid blood. The small vessels of the pia-arachnoid were deeply injected, and there were minute ecchymoses in the dura. In the pia-arachnoid, and running down into the sulci between the convolutions, could be seen a distinct yellowish-white exudate of semi-fluid consistence. The exudation had been chiefly cortical, the meninges at the base being comparatively free from it. The ventricles contained no excess of fluid, and the ependyma was smooth. There was evidence of a well-marked spinal meningitis about the middle of the dorsal region; the membranes were much dilated, and this dilatation extended below to the end of the lumbar region. On opening into the meninges, some 40 cc. of slightly turbid yellowish-white fluid containing whitish particles in suspension, escaped. In the pia-arachnoid, particularly in the cervical and lumbar regions, an extensive yellowish-white fibrinous deposit was visible. This exudate was most abundant posteriorly, and in places the tissues were distinctly hemorrhagic. The gray matter of the cord was hyperæmic, presenting a vivid pink appearance. There were punctiform ecchymoses on the serous membranes elsewhere in the body. The

heart-valves were normal; the left ventricle was firmly contracted, the right distended. In the lungs there was evidence of an acute bronchitis, but of no pneumonia. The spleen was a little enlarged, and the malpighian corpuscles grayish-white and very distinct. There was marked cloudy swelling of the glandular elements in the liver and kidneys. In the intestine the follicles were swollen, and there were minute hemorrhages into the mucous membrane. Five lumbricoid worms were included in the intestinal contents. Frozen sections showed fine fatty metamorphosis in the heart muscle, extensive fatty degeneration in the liver and kidneys, and hyaline change in the spinal muscles. Portions of the organs were fixed and hardened in bichloride solution, Flemming's solution, absolute alcohol, and Müller's fluid. Sections from these had been stained by various methods and many very interesting lesions found, the description of which would be left for the fuller report. It would suffice for the present to state simply that the meningeal exudate consisted of both mononuclear and polynuclear cells, the former varying in size from small cells with deeply staining nuclei to cells with large vesicular nuclei equal in size to six or more of the smaller ones. The protoplasm of these larger cells was usually pale and granular, but what especially distinguished them was the fact that they usually contained other cells within them, both mono- and polynuclear. The nuclei of the included cells showed in many instances evidences of degeneration and of disintegration. These peculiar large cells formed, in places, no inconsiderable part of the exudate. What their function was Dr. Flexner was as yet unprepared to say, but he believed that they had had their origin from the cells of the pia. Besides the meningitis, there was a distinct cerebritis and myelitis, and, perhaps more interesting still, there were marked pathological changes (inflammation, degeneration) in the spinal nerves. The lesions elsewhere in the body consisted chiefly of cloudy swelling of the organs, together with the occasional death of single cells.

The second case which came to autopsy was that of a girl of sixteen, in the practice of Dr. Porter, who died about three weeks after the beginning of the attack, and served to illustrate the lesions in the less acute form of the disease. On removing the skull-cap the dura was found strongly adherent, and some 200 cc. of slightly turbid fluid escaped from beneath it. The sinuses and veins were distended and the arteries prominent. There was some turbid fluid in the pia over the convexity, but on the base covering the pons and the upper half of the medulla was an extensive firm white deposit intimately adherent. In the pia covering the base was a milky-white exudate, which was especially marked in the anterior space and over the optic commissure. All the ventricles contained sticky pus, and the choroid plexuses were covered with an opaque exudate. The sheath of the auditory nerve showed a decided purulent exudate. The pia of the spinal cord, particularly on its posterior surface, was covered by a gelatinous exudate in places as much as 1 mm. in thickness. The kidneys were cloudy, swollen and cyanosed; the liver cloudy and of flabby consistence; the spleen swollen, softened and reddened.

The microscopic examination in this case showed, of course, many differences from the acute case. There were more mononuclear cells in the meningeal exudate and fewer leucocytes with polymorphous nuclei. Speaking generally, the emigrative phenomena were less pronounced, while the proliferative changes were more marked than in the acute case. The same strange cells, including other cells, were seen here, but they were not so numerous. The lesions elsewhere in the body conformed closely to those mentioned in the former case.

The most interesting problems in connection with the disease were those relating to etiology and to pathogenesis. Up to this time only a few epidemics of cerebro-spinal meningitis had been studied bacteriologically, but the results of these had been fairly constant. The investigations which had been made since the year 1886 made it seem, however, tolerably certain that the disease was due to a specific micro-organism, the micrococcus lanceolatus, the same bacterium which is the cause of acute lobar pneumonia. The micrococcus lanceolatus had been first found in the exudate in a case of meningitis by Eberth in 1880, the meningitis in his case being secondary to pneumonia. Meningitis associated with croupous pneumonia had since that time been studied by numerous observers (Bozzolo, Leyden, Weichselbaum, Fränkel, Netter, etc.) with similar results, and in the laboratory here the same micro-organism had under these conditions been several times isolated. Other micro-organisms (bacillus coli communis, the pyogenic cocci) had been found in cases of meningitis, but these had been for the most part instances of secondary meningitis, and it was probably necessary to separate the epidemic cases and put them in a class by themselves. Smear coverslips made at the autopsies in Lonaconing, and stained in the ordinary way, showed micro-organisms within and outside of cells which were indistinguishable, morphologically, from the micrococcus lanceolatus. Inoculations had also been made at the autopsies into Guarnieri, agar, and gelatin culture tubes, and the results of these, as also those of the animal experiments, would be announced later when these researches should have been finished.

If the epidemic form of the disease should prove to be due, as now seems certain, to the action of a specific micro-organism, it would be necessary next to consider the way in which the infectious agent entered the body, why it should attack especially the meninges of the brain and cord, how, if at all, it was thrown off from the body, and if thrown off, whether or not in a condition to infect other individuals. While it was impossible to give wholly satisfactory answers to all these questions at the moment, yet the data at hand, based on a close study of the epidemiology and bacteriology of the affection, made it possible to indicate a probable mode of infection, and to point out the conditions which predispose to the origin and propagation of the disease. It was a significant fact that no one condition or set of conditions could be proven to exist for all epidemics. Some stress had been laid upon the simultaneous prevalence with epidemic meningitis of certain other infectious diseases, *e. g.*, pneumonia, parotitis, scarlet fever, measles, typhoid fever, influenza and coryza. In the case of pneumonia, epidemic parotitis and some forms of coryza, the micrococcus lanceolatus was believed to be the causative agent, but in the other affections the infectious agent, so far at least as we were at present aware, was in no two of them the same. It was necessary therefore to look further than to concurrent epidemic diseases for the etiology of epidemic meningitis. Again, the theories that the epidemic form of cerebro-spinal meningitis depended on primary disease of the nasal sinuses, or upon middle ear disease, could scarcely be entertained, since we had learned to distinguish the *primary* from the *secondary* forms of the affection. Orthmann had suggested the possibility of the mouth as the source of infection through lymphatic communication, a method of invasion which as yet could not with safety be denied. The study of this epidemic made it appear likely that as in meningitis complicating pneumonia, the organisms reached the meninges through the circulating blood. It did not seem probable, however, that in these cases the micrococcus lanceolatus had entered the blood from the lungs as in the meningitis of pneumonia. On searching for a probable infection-atrium, Dr. Flexner had been led to believe that in many cases, if not in all, the intestinal canal might be regarded as affording the gateway of entrance to the infective agent. In two fatal cases which had been observed clinically during the visit at Lonaconing, there was well-marked dysentery, with blood, mucus and pus in the stools. Coverslips from the pus had revealed as the predominating micro-organism a variety indistinguishable morphologically from the micrococcus lanceolatus. Besides there had been enteritis in both the cases which had come to autopsy. Clinically, constipation was the rule in epidemic meningitis, but one could readily conceive of conditions under which the intestinal mucous membrane, without suffering any serious lesion itself, might permit the passage of micro-organisms which, gaining entrance to the circulating blood,

would locate in the tissues and multiply in the parts least resistant. It would take too long at this meeting to recite all the evidence in favor of this view. The micrococcus lanceolatus was known to exist normally in the mouths of some 80 per cent of human beings (Netter), and according to some (Kruse and Pansini) it was constantly present there. It was not difficult to imagine that under certain predisposing conditions, particularly those associated with anacidity or hypo-acidity of the gastric juice (the vomitus, tested in one patient at Lonaconing, had contained no free hydrochloric acid), the lanceolate cocci might pass through the stomach into the intestine and multiply there. However this might be, and even though further work should show that this micrococcus was not constantly associated with the disease, it would be apparent to every one who gave serious thought to the subject that many of the difficult problems connected with the epidemiology and etiology of the affection were made less difficult by regarding it as an *auto-infection*. The inconstancy of external conditions, such as pollutions of soil and of water, in different epidemics, and the non-contagiousness of the disease, were thus readily accounted for, and indeed served as arguments against a source of infection outside of the body. The sudden onset of the symptoms and their great variability, the frequent relapses in individual cases, the different types of the disease, the occurrence of joint-effusions in a considerable proportion of those attacked, all were consonant with what might have been expected from the action of a rapidly growing but easily succumbing and virulence-varying bacterium, such as we knew the micrococcus lanceolatus to be. The obscure question of *predisposition*, the peculiar and unusual conditions which rendered the system vulnerable to infection, and which determined by preference the localization of the morbid process in the meninges of the brain and spinal cord, still remained to be considered. The fact that all classes suffered—strong and weak, well-to-do and poor—more or less alike, pointed to a predisposition of the whole community, outside of the merely personal predisposition, and yet in the end the resistance of the tissues of each individual must necessarily be of prime importance in determining infection or immunity.

The opportunities for the study of the disease had been exceptional, no epidemic of such magnitude having prevailed in the United States, or in fact elsewhere, for many years, and the complete report, which he trusted would not long be delayed, promised to be of exceptional interest. Dr. Barker acknowledged gratefully many kindnesses received by Dr. Flexner and himself at the hands of Dr. Chancellor of the State Board of Health, Drs. Skilling and Skilling, Drs. Porter and Porter, and Dr. Bullock, of Lonaconing, and Dr. Smith, of Ocean; without their aid the investigations would have been impossible.

Recurrent Carcinoma in Post-rectal tissues with Metastases; Death from Infection with the Streptococcus Pyogenes.—Dr. BARKER.

The specimens which I wish to present to the Society to-night are from an autopsy made on Friday last. The patient (service of Dr. Halsted), a gentleman, æt. 36, had applied for treatment first about one year ago. He complained at that time of stricture of the rectum, and on examination it was found that he was suffering from well-marked carcinomatous disease. He was operated upon by Dr. Halsted, who removed the whole of the rectum, a portion of the sigmoid flexure of the colon, and much of the surrounding tissues. In order to facilitate the removal of these structures, the coccyx and a portion of the sacrum were excised. It seemed at the end of the operation as though all tissues which could possibly have been invaded had been cut away, and as microscopical examination of the periphery of the tissues removed failed to reveal any groups of epithelial cells, it was hoped that the ultimate result in this case might be favorable. The gentleman, however, returned some nine months later for a secondary plastic operation, and during his stay in the hospital it became evident that metastases had formed in the liver. From this time on he progressively emaciated, the liver grew larger and larger, the cancerous cachexia became well marked, and recently morphia had been frequently required for the relief of his pains.

At the autopsy there was considerable œdema of the legs, the subcutaneous fat was scanty in amount, and the body generally emaciated. Over the left great trochanter was a small ulcer measuring 1×2 cm., apparently the result of pressure. The peritoneal cavity contained about 1000 ccm. of yellowish fluid in which were many flakes and masses of yellowish-white inflammatory lymph. The liver and spleen were bound down by old and moderately firm adhesions. There were old fibrous adhesions over the upper portions of both lungs. In the left lung, both on the surface and deep in the substance, are firm nodules varying in size from that of a pin's head to that of a large pea. Some of these nodules are surrounded by a distinct zone of hyperæmia; on section they are opaque and grayish-white in color. They represent small tumor metastases, and correspond in structure, as the frozen sections show, to those found in the liver. The bronchi contain considerable fluid, and much frothy fluid can be squeezed from the lung. The bronchial glands are a little enlarged and moderately pigmented with coal. In the right lung there are also many metastases, and on the whole the nodules are rather larger than those in the left lung, although here too there are numerous small ones. The lower lobe of this lung is heavy, deep dark red in color, and from it much frothy fluid exudes. The heart weighs 240 grammes, circumference of tricuspid valve 11 cm., of mitral valve 10 cm., of aorta just above valve 6.8 cm. Length of right ventricle 7 cm., of left 7 cm.; thickness of right ventricle 5 mm., of left 13 mm. A few elevated opaque yellowish-white areas of sclerosis are visible upon one of the curtains of the mitral valve, and in the aorta just above the aortic valve, especially about the orifices of the coronary arteries. The anterior coronary artery is moderately dilated and shows numerous sclerotic patches; in the posterior coronary there are fewer of these, situated for the most part near its origin from the aorta. There are no marked changes in the myocardium, which is brown and firm. The pericardium is smooth, the epicardial fat scanty, and the subepicardial tissues œdematous. The liver, as is seen at once, is very much enlarged. In the middle line it extended for a distance of 14 cm. below the tip of the xiphoid cartilage, in the right mammillary line 12 cm. and in the anterior axillary line 9 cm. below the costal margin. The organ weighs 5700 grms., and measures 32×28×16 cm. It is adherent to the diaphragm over a large part of the superior surface, and below is firmly attached to the intestine and omental tissues. Over the whole surface are scattered these larger and smaller yellowish-white nodules with raised margins, and frequently with depressed cicatricial centers. These nodules vary from 5 mm. to 6 cm. in diameter, and on section are yellowish-white, and show dry opaque areas. Judging from the cut surface, not more than two-fifths of the whole liver can consist of liver-substance; in the left lobe there is scarcely any liver tissue remaining, it having been almost entirely replaced by the neoplastic growth. In the gastro-hepatic omentum there is a chain of much enlarged lymph-glands, all cancerous. The bile is dark greenish-brown in color and transparent; in the wall of the gall-bladder are several firm metastatic cancer nodules.

The spleen weighs 370 grms.; dimensions 17×9×4 cm. The capsule is wrinkled and covered with fresh inflammatory lymph. In consistence the organ is flabby, but not particularly soft; on section the tissue is purplish-red in color and nearly homogeneous; the malpighian bodies are invisible.

The kidneys together weigh 410 grms. The right kidney measures 12×6×4 cm. The capsule strips off easily except in certain areas where the tissue tears away with it. These areas vary in size, one measuring 2½ cm. across, are slightly elevated, consist of softened tissue, and on section are seen to be pale grayish-yellow in color and to extend sometimes into the pyramids. Some of them

are distinctly wedge-shaped. The cortex of this kidney averages 7 mm. in thickness; the striæ are visible and nearly normal in appearance. There are a few nodules deep in the substance of the kidney corresponding to those described as reaching the surface of the organ. The pelvis of the kidney is a little dilated and its mucous membrane hyperæmic. The left kidney is somewhat smaller than the right; its capsule is moderately adherent. It is free from nodules. The adrenal glands show nothing abnormal.

The stomach and intestines, with the exception of the external adhesions, present nothing abnormal. The peritoneum covering them is hyperæmic, dull, and covered with a fibrinous exudate. The pancreas is firm and has not been invaded by the tumor nodules, although the lymph-glands in its neighborhood are converted into large cancerous masses. At the anus one can make out that the rectum has been removed and the end of the gut above brought down and stitched to the anal margin. Union has been complete except over a small granulating surface, and there is no tumor growth in the wall of the intestine. In the tissues behind, however, corresponding to the lower portion of the hollow of the sacrum, there is a large necrotic mass about the size of a small fist. The new growth has invaded all the adjacent tissues, muscles, nerves and bone. The lymph-glands along the aorta (retro-peritoneal) are a little enlarged and contain yellowish-white masses of cancer-metastasis. The prostate gland is slightly enlarged; the urethra, bladder and testicles are normal.

Frozen sections were made from all the organs immediately after the autopsy. Those from the liver showed that the tumor-nodules consist of epithelial cells arranged in alveoli, the latter being embedded in connective tissue stroma. In places it was possible to make out a definite tendency toward the formation of gland-alveoli lined by columnar or cubical epithelial cells. The liver cells in the neighborhood of the cancerous nodules are often distorted and show more or less extensive fatty and pigmentary degeneration. The sections of the kidney show nodules of epithelial growth, especially at the apices of the infarcted regions.

Anatomical Diagnosis.—Recurrent carcinoma in post-rectal tissues; metastases in liver, wall of gall-bladder, lungs, right kidney and retro-peritoneal lymph-glands; infarction of kidney; sclerosis of aorta and of coronary arteries; acute sero-fibrinous peritonitis.

It will be evident to all that from the tumor and its metastases alone there was no reason why the individual from whom these tissues have been taken should have died so soon. Certainly the growths in the liver are extensive and a large portion of the liver-substance has been destroyed, but we know very well that a patient may be deprived slowly of a much larger amount of liver tissue than has been the case here, without death necessarily resulting, and this Society has more than once had the opportunity of seeing examples of such advanced liver-destruction. It would seem desirable therefore to draw especial attention to the immediate cause of death in this instance, the acute peritonitis, especially since the findings in this case are quite in accord with our modern ideas concerning the most frequent modes of death in chronic diseases of various kinds—conceptions which have only been possible since bacteriological methods of investigation have been systematically applied to the study of post-mortem material. The case of peritonitis (due to the proteus vulgaris) terminating Bright's disease recently presented to this Society by Dr. Flexner, and the remarks made at that time by Dr. Welch on the terminal inflammations in general, are still fresh in our minds.

At the autopsy we are describing, culture-tubes of nutrient agar were inoculated with portions of the peritoneal exudate, and in these there developed, after twenty-four hours in the thermostat at 37° C., very numerous minute colonies which on examination and by further growth on various media were proven to be the streptococcus pyogenes. The results of cultures agreed entirely with what had been found in smear cover-slip preparations made from the exudate, as these prepared in the ordinary way had shown along with mono- and polynuclear cells, very numerous cocci in short and long chains, and no other micro-organisms. The streptococcus is well known to be a frequent cause of peritonitis, it being outranked in frequency as an etiological factor of the disease only by the bacillus coli communis. It is always a matter of interest in a given case of peritonitis to determine if possible the way in which the infective agent has gained entrance to the peritoneum. There was here no visible *direct* infection-atrium (*e. g.* a diseased appendix or intestinal perforation), and indeed had there been such a direct communication with the gastro-intestinal canal one would have expected to find, as has been the rule in the experience of those who have worked in the laboratory here, either the bacillus coli communis alone, or it associated with one or more other organisms such as the streptococcus. The only conclusion to be drawn is that in this peritonitis the streptococci reached the peritoneum by way of the circulating blood. That this is the correct explanation is supported by the fact that agar Esmarchs made from the organs of the body (liver, spleen, lung, and kidney) gave numerous colonies of the streptococcus pyogenes. We have then to deal in this case with a general infection of the body with a pyogenic micro-organism, and with a peritonitis dependent for its origin on the same kind of bacterium. A moment's thought brings to mind analogous findings in the field of experimental pathology. Any one who has had much experience with the action on rabbits of organisms which are capable of giving rise to a general infection (*e. g.* the micrococcus lanceolatus) will be familiar with the fact that where one employs a culture of low virulence, a small dose, or an animal which is naturally or has been artificially rendered somewhat resistant, there may result from intravenous inoculation, instead of the ordinary acute septicæmia and sudden death, a more slow infection, with death, say after a number of days, and at the autopsy an inflammation of a serous membrane (peritoneum, pleura, pericardium) be found, the lesions elsewhere in the body being comparatively insignificant.

We are justified, we think, in assuming that in this individual, then, the streptococci entered the circulating blood in small numbers or in a condition of feeble virulence; or if they were very virulent, they found in the fluids and cells of the body sufficient resistance to growth, multiplication, and production of toxic products to prevent the development of the phenomena of acute septicæmia. Finally, just how the organisms gained entrance to the blood it would be difficult to decide. There were several gates open to them. We may think of the skin-lesion over the left hip, or of the granulating surface at the anus, or since we now believe that under lowered systemic conditions, virulent organisms may pass through the mucous membrane of the alimentary tract without any demonstrable lesion there, it is not impossible that the circulating blood and the tissues of the body may have been thus invaded.

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